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1. INTRODUCTION

This Attachment was prepared in support of Excelsior Mining Arizona, Inc.’s (Excelsior’s) Underground Injection Control (UIC) Permit application to the United States Environmental Protection Agency (USEPA). Excelsior is applying for an area Class III UIC permit to install a wellfield for in-situ recovery (ISR) of copper at the Gunnison Copper Project (Project), located in Cochise County, Arizona. This attachment provides information regarding injection procedures for the ISR wellfield.

2. DESCRIPTION OF OPERATIONS

2.1 Process Description

ISR will consist of blocks of injection wells and recovery wells constructed to circulate lixiviant throughout the mineralized bedrock and recover acid soluble copper from the ore body. Injection and recovery wells will be interspaced in an alternating and repeating pattern throughout the wellfield. Figure K-1 shows a five-spot pattern in which each injection well is surrounded by four recovery wells. In practice, this arrangement may be revised to optimize recovery, based on geologic and hydrogeologic conditions observed during the installation of the wellfield. Aquifer testing will be performed at installation, and used to determine the optimal wellfield array configuration.

At the surface, copper will be removed from the extracted solutions at a solvent extraction-electrowinning (SX-EW) plant where pure copper cathode will be produced. Initially, the SX-EW plant and impoundments at the nearby Johnson Camp Mine (JCM) will be used. As production ramps up, an additional SX-EW plant and impoundments will be constructed at the Gunnison Copper Project site. After processing, the fluid will be recycled to the wellfield to begin the leaching cycle again.

The locations of the proposed facilities are shown on Figure K-2.

2.2 Injection Process

Injection and recovery wells for each mining block will be plumbed to injection and extraction headers in a centralized “header house” building. Each header house will be connected to up to 60 wells. Mechanical equipment in the header house consists of flow control valves on the injection and recovery wells. Recovery wells will be equipped with submersible pumps with starters and controls in the header house. Sampling ports will be accessible in the header houses.

Instrumentation for the injection and recovery wells will be similar. Each well will be equipped with a magnetic flow meter. Injection pressure will be monitored in each injection well with a pressure gauge to ensure that pressures don’t exceed allowable limits.

The mechanical equipment and instrumentation will be controlled and monitored by a computerized plant control system (PCS) located in the wellfield control room in the EW building. Communications between the PCS and the wellfield is maintained using a fiber-optic/Ethernet network or other such appropriate communications network. Each header house will consist of a climate-controlled room with motor starters and monitoring and control equipment connected to the PCS. Communication between the PCS and the main control enclosure will be by fiber-optic cable. Pressure gauges will be read and recorded manually and flows will be controlled by manual adjustment of the control valves.

The operator in the control room will use the PCS to monitor flow rates at each well to ensure that flow balance is maintained. Conditions out of the operating range or needing correction will be reported to the wellfield operators. Sensitive electronic equipment will be kept cool and dry in a separate, air conditioned compartment and a human-machine interface (HMI) in the "wet" side of the header house will allow the wellfield operators to monitor operational parameters, such as flow rates and power consumption, and adjust the flow control valves manually.

The PCS will also be equipped with data loggers to record information from the instruments at each well to enable the operator to examine trends, calculate local and cumulative flows, set alarm conditions, and maintain production records. The PCS will provide trending, historical and alarm data for flow, power draw, and any other required instrumentation. Injection pressure will be recorded manually and entered electronically to the data loggers to ensure that injection pressure is stable and doesn't exceed the stipulated limits. Alarms will be triggered when flow rates or fluctuations are out of limits set by the operator. Alarms will also be generated when there is a communications fault, equipment or instrument failure or a process that is out of control limits.

2.3 Injection Rates

Injection rates are discussed in Attachment H.

2.4 ISR Process

ISR process diagrams for each of the three Stages (Figures K-3, K-4, and K-5) depict the nominal design flows for each Stage of the Project.

Descriptions of the flows and their relationship to the process are provided below. Actual flow rates and compositions will vary with time and experience.

In Stage 1, the water used to rinse the formation after each block is depleted will be neutralized and evaporated or recycled for use as makeup water for the Raffinate Pond. In Stages 2 and 3, rinse water will be conveyed to a water treatment plant (WTP) for treatment and reuse in rinsing. The WTP will be constructed prior to Stage 2 rinsing to treat water produced by rinsing of the formation.

Each stream flow is discussed below:

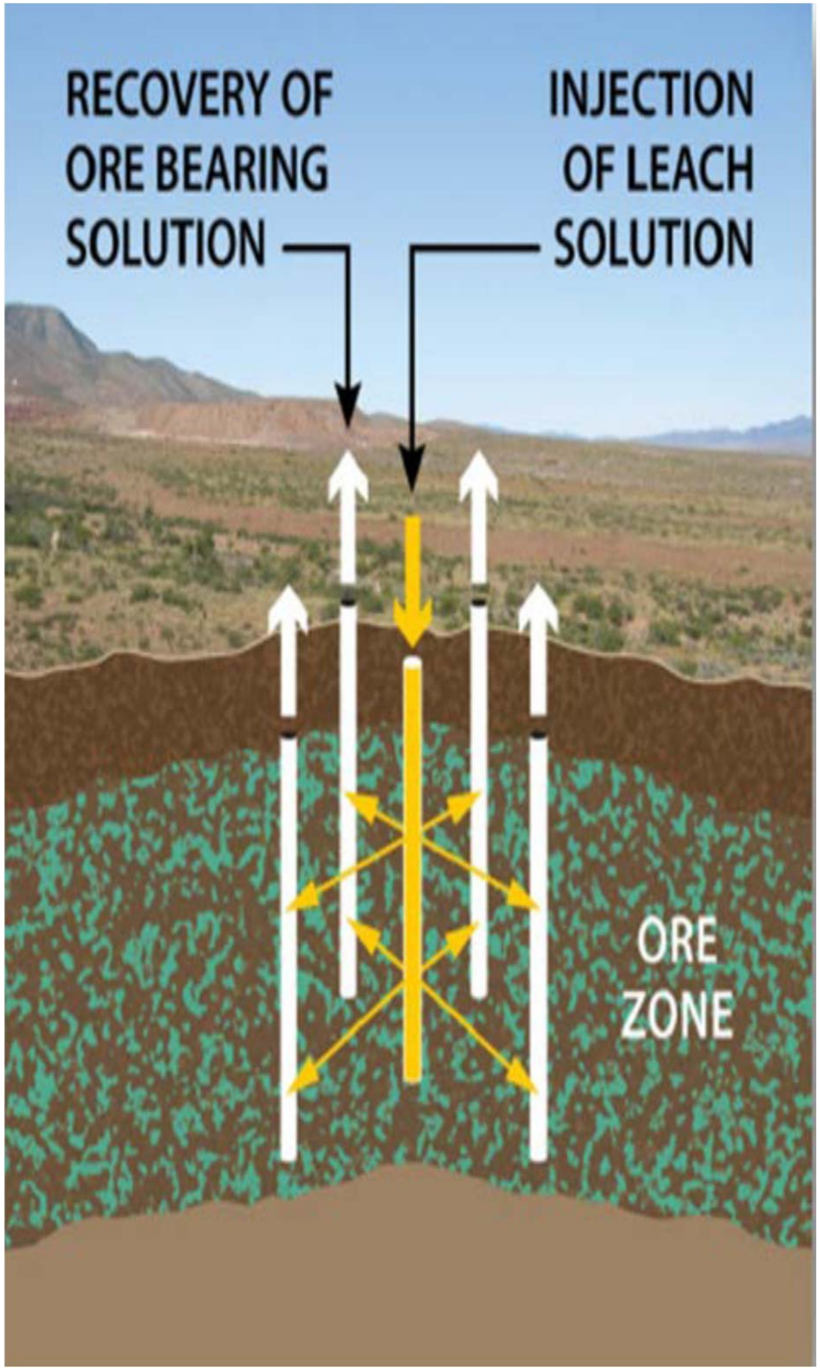
- Stream 1: The ISR process will begin when acidified leach solution is pumped from the Raffinate Pond to the wellfield. The leach solution will be drawn through the bedrock formation dissolving copper, which will be pumped out by the extraction wells, and discharged into the PLS Pond (Stream 2). The aggregate flow rate to the injection wells, shown as the nominal design flow 3,880 gallons per minute (gpm), will vary up to a maximum of 4,800 gpm during Stage 1 operations.

- Stream 2: The predicted concentration of PLS recovered from the wellfield is 1.63 grams per liter (g/L). Extraction wells will contribute to the PLS manifold system that discharges to the PLS Pond.
- Stream 3: PLS will be pumped from the PLS Pond to the SX-EW plant to extract copper from the PLS. The copper-rich PLS will be stripped of 92% of its copper content in the SX circuit and returned to the Raffinate Pond. Copper stripped in the SX circuit will be electroplated in the EW circuit and recovered as copper cathode sheets (Stream 6).
- Stream 4: Leach solution depleted of copper by the SX process is called raffinate and requires addition of sulfuric acid to compensate for the acid used in the ISR wellfield to dissolve copper minerals and liberate copper to the PLS. This sulfuric acid addition can take place in the SX circuit or, more commonly as described here, in the Acid Mix Tank. Raffinate from SX (Stream 4), makeup (Stream 9), and sulfuric acid (Stream 5) will be mixed under turbulent conditions in the Acid Mix Tank to ensure thorough mixing and dissipate the heat of mixing.
- Stream 5: Sulfuric acid will be added to create the barren leach solution for dissolving copper-bearing minerals in the ISR wellfield. The electrolyte used in the EW circuit for copper cathode plating is also a sulfuric acid solution. Stream 5 represents the supply of sulfuric acid that will be needed for the entire process.
- Stream 6: Copper cathode sheets will be the primary product of the operation. Plated copper on the cathode blanks will be removed in a stripping machine and bundled for offtake by purchasers. The value of this flow stream is shown on the respective diagram in millions of pounds of copper per annum.
- Stream 7: Leach solution needs to be circulated through the formation for a considerable time period before the extracted solution approaches PLS grade and can be circulated to the SX-EW plant. Barren leach solution from the Raffinate Pond will be injected into wells that are planned for the next production period (Stream 7). The extracted solution (Stream 8) will vary from natural groundwater to low-grade PLS solution with time. This Pre-Production step (also called “wellfield conditioning”) is expected to require approximately 3 months.
- Stream 8: The low-grade solution extracted during pre-production wellfield conditioning will be conveyed to the Recycled Water Pond. During Stage 1, late stage rinsing water (Stream 15) will also be added to this pond, with the excess conveyed to the Evaporation Pond (Stream 10).
- Stream 9: Recycled solution from wellfield conditioning (and rinsing) will be conveyed to the Raffinate Pond to make up for the additional leach solution from raffinate required for wellfield conditioning. Acid addition (Stream 5) will be adjusted to bring the acid strength of the leach solution to the desired concentration for effective copper extraction.

- Stream 10: Excess water from the Recycled Water Pond will be conveyed (Stream 10) to the Evaporation Pond where it will become a component of the water that is released to the atmosphere by mechanical evaporation to eliminate the need for discharges from the facility.
- Stream 11: Hydraulic control wells will be located around the wellfield to ensure that leach solutions that might escape from the active wellfield are captured before leaving the AOR which is further discussed in Attachment A. The groundwater produced from hydraulic control pumping will be conveyed to the Clean Water Pond used to mitigate the need for makeup water from supply wells.
- Stream 12: Water will be taken from the Clean Water Pond to rinse depleted sections of the wellfield (Stream 13). Clean water that is needed in excess of the groundwater supplied by the hydraulic control wells will be supplied by water supply wells, the location(s) of which are to be determined.
- Stream 13: Water from the Clean Water Pond will be used to rinse the formation at the end of a block's useful production life. Rinsing will be conducted in two stages with a rest period in between. Early stage rinsing will reduce the concentration of leach solution in the formation. The rest period will be used to neutralize the solution. Late stage rinsing will reduce the concentrations of constituents to numeric Aquifer Water Quality Standards (AWQSs). Sources of water to the Clean Water Pond will include hydraulic control water (Stream 11) and groundwater from water supply wells (Stream 13). In Stages 2 and 3, clean water will be augmented by treated water from the WTP (Stream 18). Clean water will be injected (Stream 13) into the formation and recovered (Stream 14) to reduce concentrations of regulated constituents.
- Stream 14: Rinse water removed from the formation typically will have elevated levels of constituents and will require recycling, evaporation or water treatment in Stages 2 and 3.
- Stream 15: Extracted rinse water from the late stage rinsing will be conveyed to the Recycled Water Pond for use as makeup water for the Raffinate Pond (Stream 9).
- Stream 16: Extracted rinse water from the early stage rinsing will be conveyed to the Evaporation Water Pond and released to the atmosphere (Stream 21).
- Stream 17: A WTP will be constructed to treat rinse water in Stages 2 and 3. The treatment process will include neutralization, water conditioning, microfiltration, and reverse osmosis (RO). The process requires a variety of reagents that are introduced in liquid form. Stream 17 represents an aggregate flow for the reagents used in the water.
- Stream 18: The WTP will be designed to recover approximately 80% of the influent as clean water (Stream 18) suitable for reuse in the process or for restoring formation water quality. The remainder of the flow will be conveyed either to the solids impoundment with precipitated solids (Stream 20) or the Evaporation Pond as reject brine and filter backwash (Stream 19).
- Stream 19: Two streams of reject water will be produced by the WTP. This water will be conditioned and filtered to remove solids prior to reverse osmosis treatment. The filter

backwash, containing some solids, and the RO reject water are both designed to be routed to the Evaporation Pond (Stream 20).

- Stream 20: The WTP will be designed to produce high density solids during the neutralization of treated water. Addition of lime raises the pH causing the precipitation of metal hydroxides and sulfate minerals. The solids will settle in a clarifier to maximize water recovery and solids density. Clarifier underflow, consisting of precipitates, will be routed to a Solids Impoundment (Stream 20)
- Stream 21: Water that cannot be reused for process or rinsing purposes will be sent to the Evaporation Pond where it will be released to the atmosphere by natural and mechanical evaporation (Stream 21). Mechanical evaporators floating on the surface of the evaporation pond will spray mist into the air and up to 70% of the water will be evaporated.



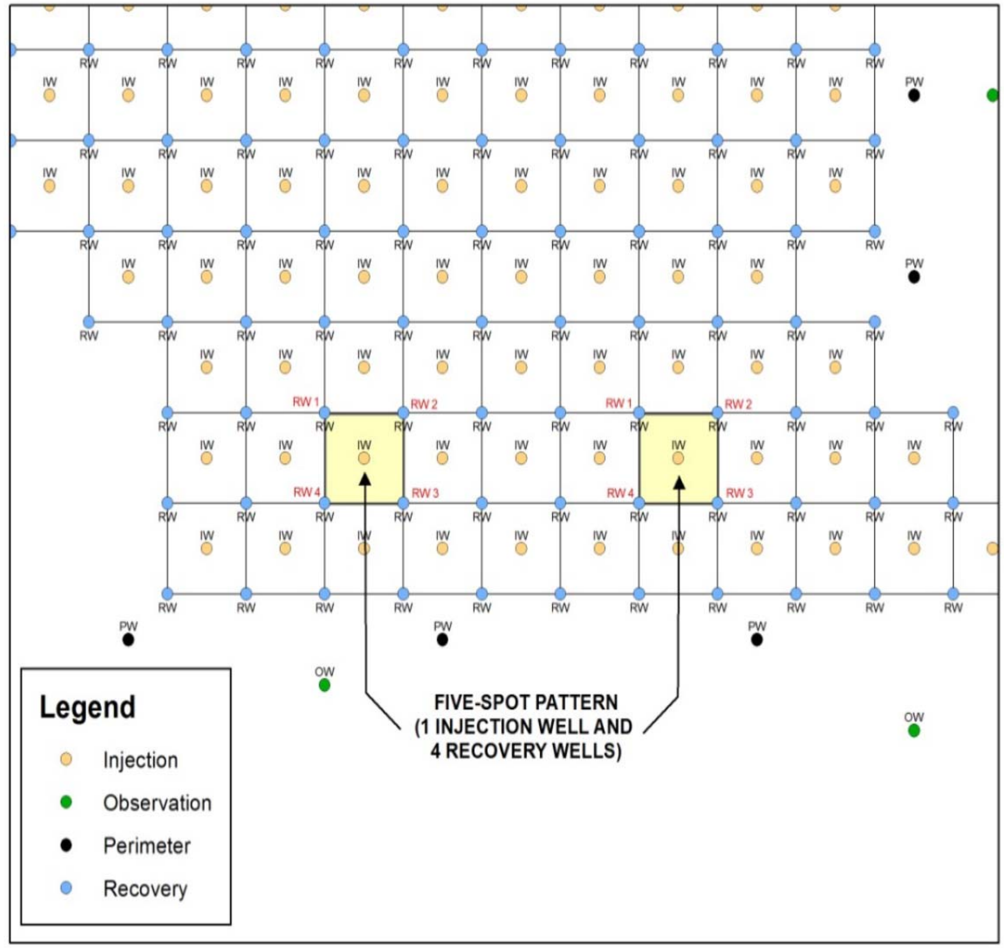


Figure taken from *NI 43-101 Technical Report Prefeasibility Study Cochise County, Arizona, USA* (M3, 2014)

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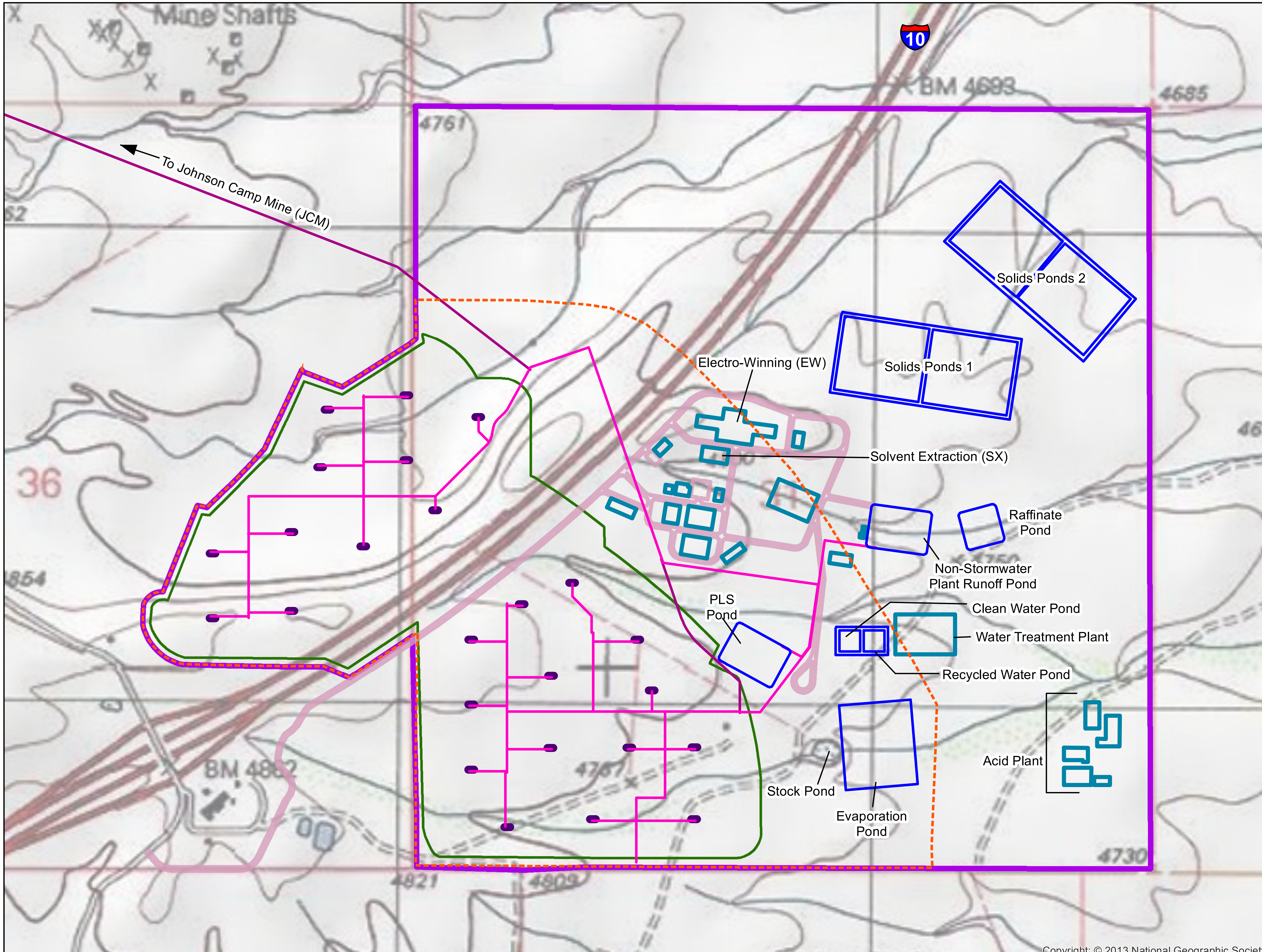
FIGURE K-1
Schematic View of Wellfield Layout



Legend

- Gunnison Copper Project
- ISR Wellfield
- Area of Review
- Ponds
- Building/Structure
- Pipeline to JCM
- ISR Wellfield Piping
- Header House (Monitoring Point)
- Road

0 325 650 1,300
Feet

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FIGURE K-2
Site Plan

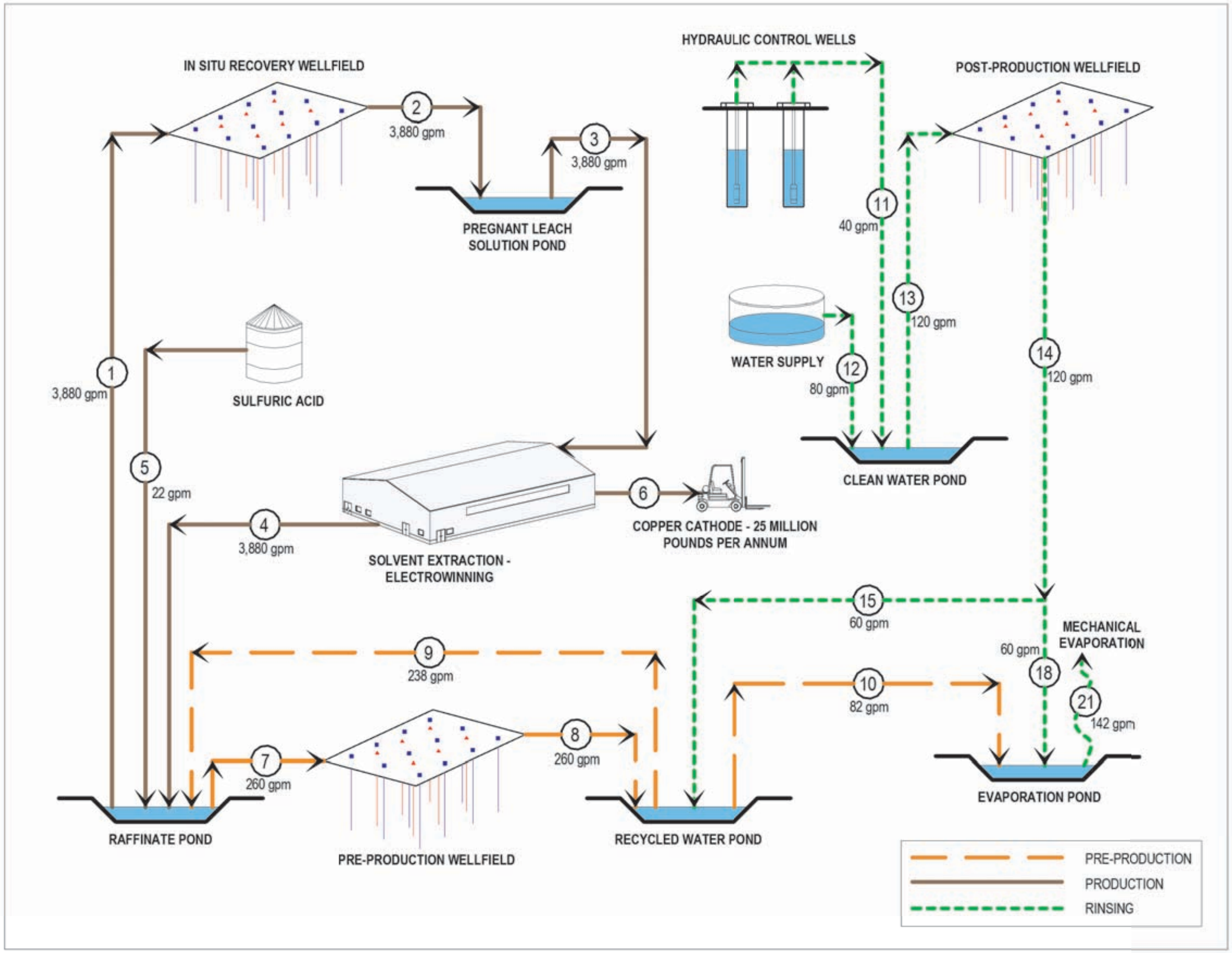

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FIGURE K-3
Stage 1
In Situ Recovery Process

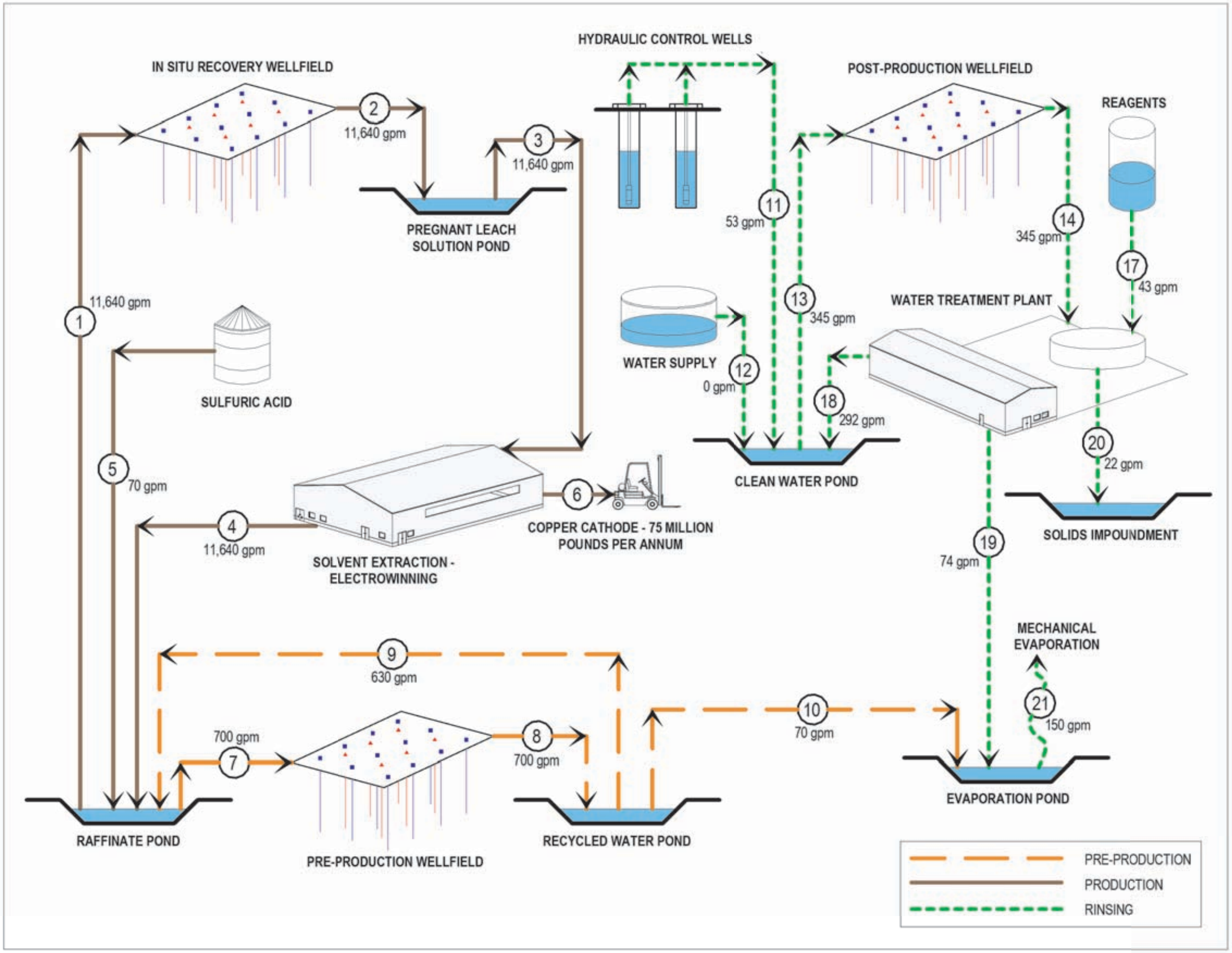

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FIGURE K-4
Stage 2
In Situ Recovery Process

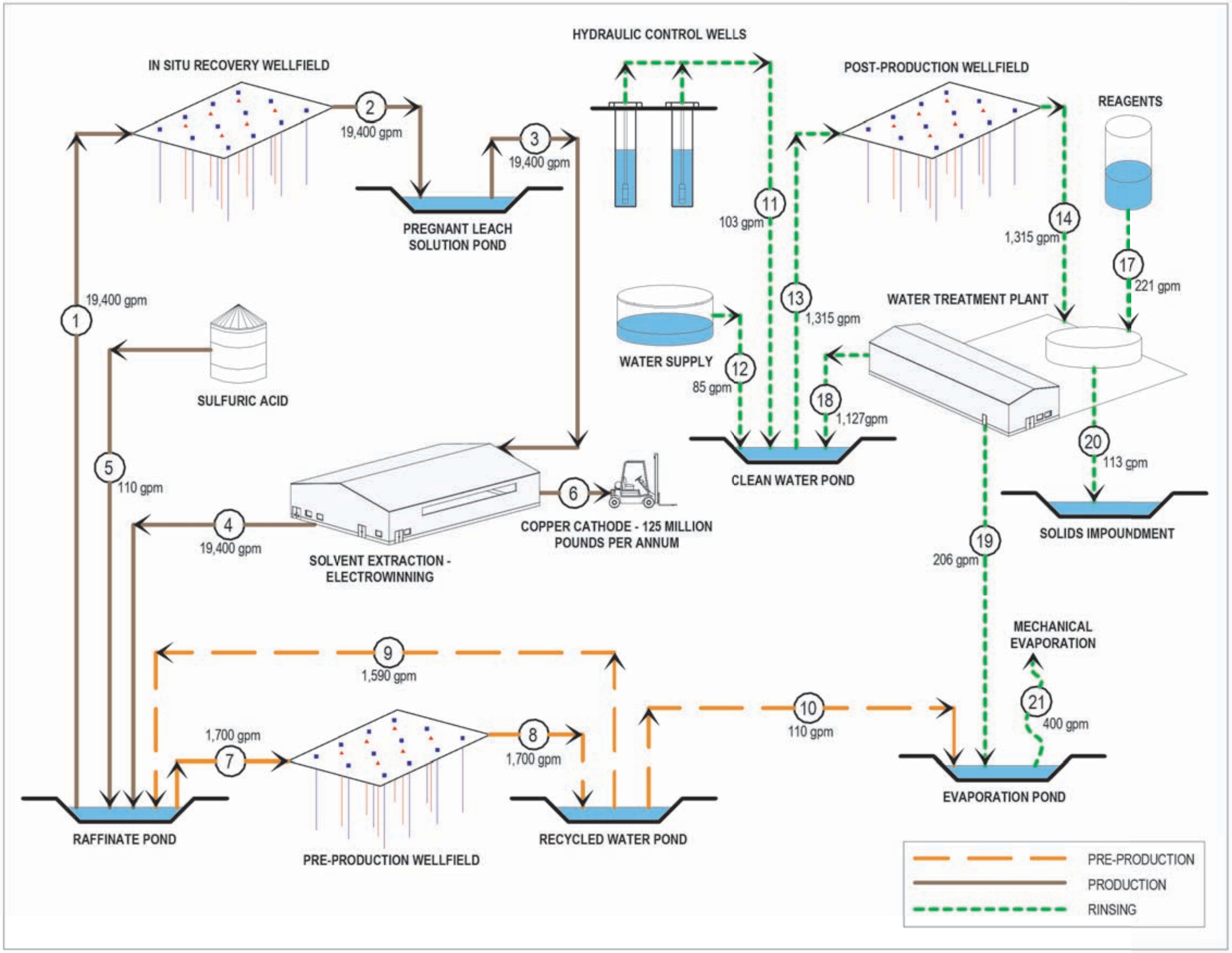

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FIGURE K-5
Stage 3
In Situ Recovery Process

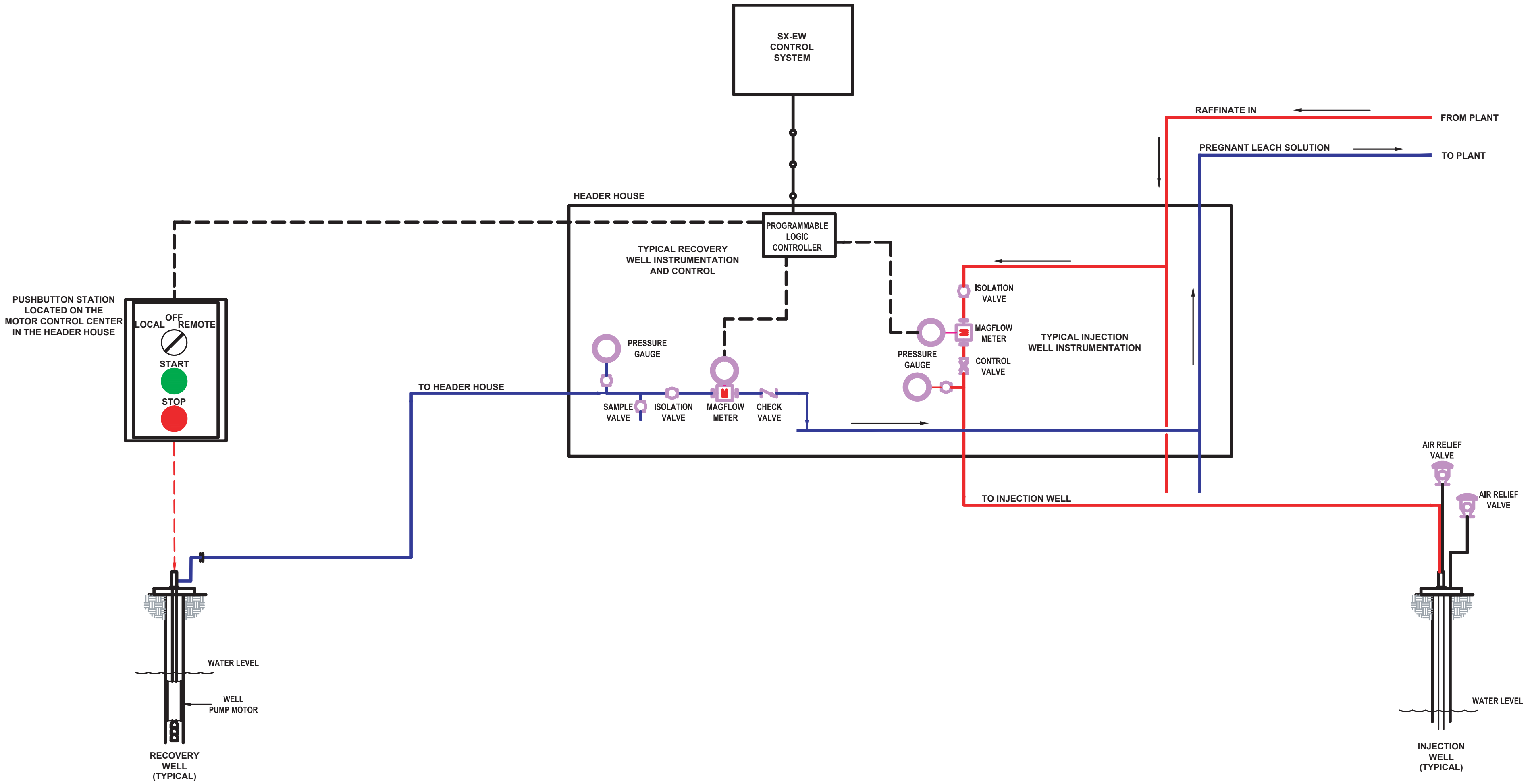

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FIGURE K-6
Wellfield Controls